AIAA cites staffer for paper of year

Dr. Marvin E. Goldstein of the Physical Science Division was presented the "Paper of the Year" award by the Cleveland-Akron Section of the American Institute of Aeronautics and Astronautics (AIAA) at its final meeting of the season. Dr. Goldstein's paper entitled "New Aspects of Subsonic Aerodynamic Noise Theory" was selected from over 30 papers. New officers for the coming season included two Lewis employees. They are Harry E. Bloomer, secretary, and Donald R. Boldman, treasurer. Pictured above are Professor Simon Ostrach (left) presenting the award to Dr. Marvin Goldstein.

Lewis News

June 1, 1973

Former Applied Mechanics Group Members Elected To National Academy Of Engineering

Four former Lewis employees, who worked together as an Applied Mechanics Group in the 1950's, have all been elected to the prestigious National Academy of Engineering.

Election to the National Academy of Engineering is one of the highest professional distinctions that can be conferred on an engineer. It honors those who have made important contributions to engineering theory and practice or who have demonstrated unusual accomplishments in the pioneering of new and developing fields of technology. Nationwide, the academy has 1285 members in 12 fields of engineering.

The four former employees elected to the NAE are: Simon Ostrach Wilbert J. Austin Distinguished Professor of Engineering, Case Western Reserve University; Franklin Moore, Joseph C. Ford Distinguished Professor of Mechanical Engineering, Cornell University, Ithaca, NY; Steven Maslen, Associate Director, Martin Marietta Research Laboratories, Baltimore, MD; and Harold Mirels, Principal Scientist, The Aerospace Corp., Los Angeles, Ca.

"We had a wonderful time working together at Lewis," says Ostrach. "We're looking forward to getting together again at the Academy's next meeting."

Lewis News: December 11, 1987

Lewis Project Teams Develop Hardware For Experiments Aboard The Shuttle's U.S. Microgravity Laboratory And U.S. Microgravity Payload

If the United States is to achieve its goal of expanding human presence and activity beyond Earth orbit, then we must have a much greater understanding of the effects of microgravity on basic physical, chemical, and biological processes. That's why NASA's Office of Space Science and Applications (OSSA) conducts enabling research in the microgravity of low-Earth orbit.

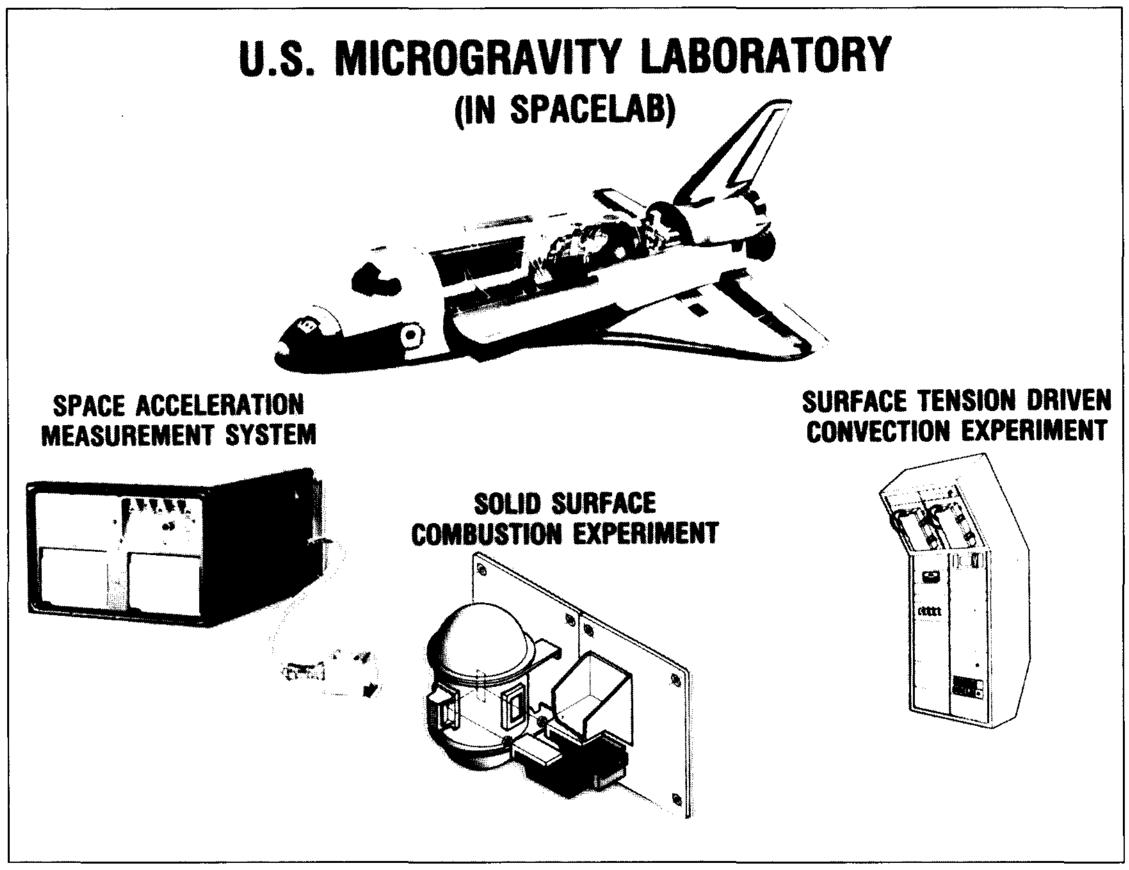
But research in the microgravity environment may also lead to a material or materials processing approach that may have significant commercial value on Earth. In addition to basic microgravity research, OSSA leads applied materials processing research in five major categories: electronic and photonic materials; metals, alloys, and composites; glasses and ceramics; polymers; and biological materials.

Later this decade, the U.S. Laboratory aboard Space Station Freedom will become the Nation's centerpiece for microgravity research. But until then, NASA will intensify its microgravity research aboard the space shuttle. Within the next three years, NASA will begin launching a series of shuttle missions dedicated to U.S. microgravity experiments.

U.S. Microgravity Laboratory Missions

The U.S. Microgravity Laboratory (USML) missions aboard the shuttle will use Spacelab, a pressurized module accessible by the crew via a tunnel from the middeck of the orbiter. The crew will conduct the experiments, which will be housed in laboratory rack equipment.

There will be a number of USML missions in the 1990s, with the first scheduled for March 1992. USML-1 will carry 12 microgravity experiments in the Spacelab and seven in the middeck of the orbiter.



For the first U.S. Microgravity Laboratory mission scheduled for March 1992, Lewis teams are preparing the Space Acceleration Measurement System (SAMS), the Solid Surface Combustion Experiment (SSCE), and the Surface Tension Drive Convection Experiment (STDCE).

U.S. Microgravity Payload Missions

Another carrier for microgravity experiments will be the U.S. Microgravity Payload (USMP), a structure that will fit across the orbiter's payload bay and provide the necessary thermal, data, and power accommodations.

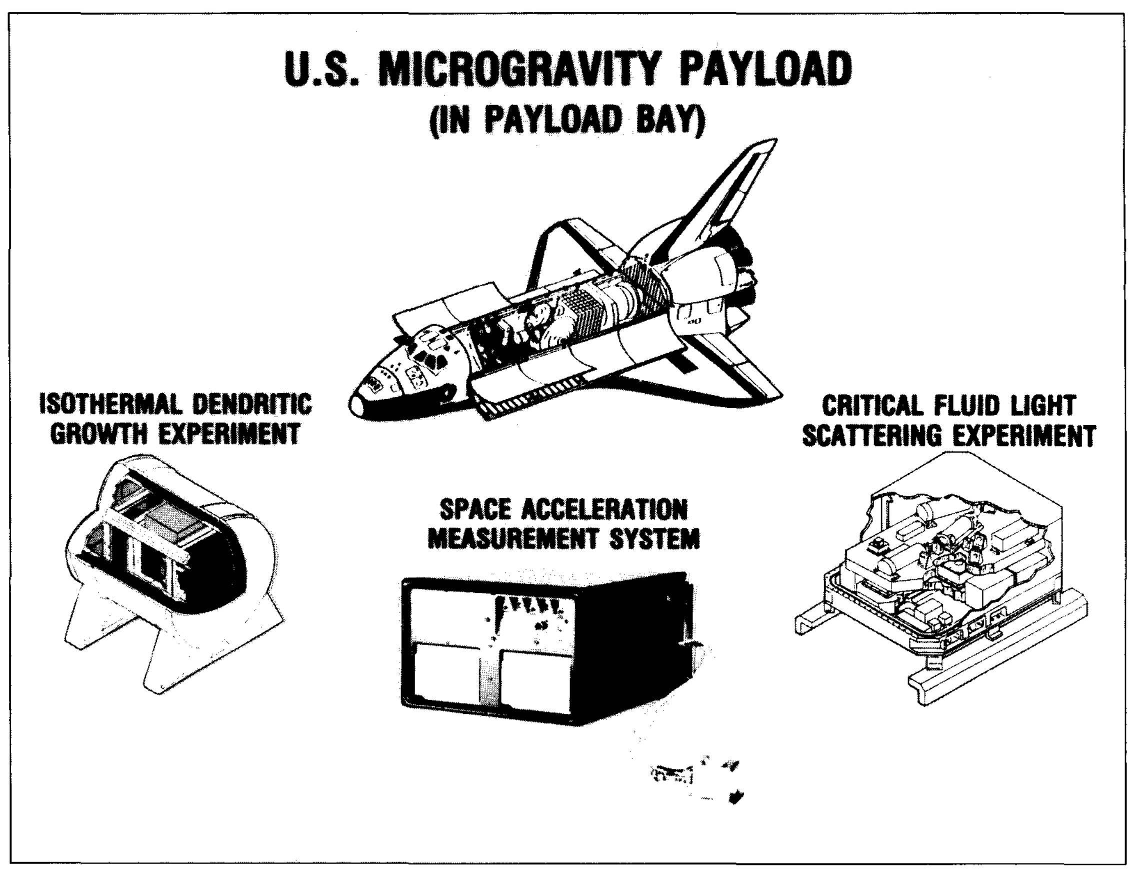
Experiments to be flown on the USMP are typically too large to be accommodated within the Spacelab module or require a more quiescent environment without human intervention.

Lewis Role In USML And USMP Missions

For the first USML mission, Lewis employees are preparing three experiments: the Surface Tension Drive Convection Experiment (STDCE); the Solid Surface Combustion Experiment (SSCE); and the Space Acceleration Measurement System (SAMS).

The SAMS will provide the microgravity acceleration environment data required by the two experiments.

For the USMP mission planned for March 1993, Lewis is developing hardware for the SAMS and two experiments: the Isothermal Dendritic Growth Experiment (IDGE) and the Critical Fluid Light Scattering Experiment, also known as Zeno.



For a U.S. Microgravity Payload (USMP) mission in 1993, Lewis teams are working on the Isothermal Dendritic Growth Experiment (IDGE), the Space Acceleration Measurement System (SAMS), and the Critical Fluid Light Scattering Experiment, also known as Zeno.

How Lewis Supports NASA's Microgravity Research

At Lewis, the Space Experiments Division is actively involved in the combustion, fluid physics, and materials elements of NASA's microgravity research program.

In addition to conducting independent research, the Division's scientists work with principal investigators selected as candidate flight experimenters through a peer review process. The Division helps the principal investigator determine the science requirements of the proposed experiment, perform ground-based testing in the Lewis drop towers or Learjet, define an experiment concept, and develop the rationale to perform a space flight experiment.

Once the proposed experiment is selected by NASA Headquarters for flight aboard the shuttle, the Space Experiments Division manages the development of hardware needed to conduct the experiment. This process requires the support of many organizations at Lewis including the Engineering Directorate, the Office of Mission Safety and Assurance, the Technical Services Directorate, and the Office of the Comptroller. The Space Experiments Division is also aided in its work by support service or prime contractors.

Other Upcoming Lewis Microgravity Experiments

Before the first USML mission is launched in 1992, Lewis will have flown several microgravity experiments aboard the shuttle.

This August, the initial Solid Surface Combustion Experiment (SSCE) is scheduled to fly on the first Spacelab Life Sciences mission. This mission, STS-40, will also include the initial Space Acceleration Measurement System (SAMS) data collection, and a gallium arsenide crystal growth experiment jointly developed by Lewis, the Air Force, and GTE. SSCE and SAMS are scheduled for several additional Spacelab and middeck opportunities in late 1990 and 1991.

On the International Microgravity Laboratory mission (STS-42) in December 1990, a Lewis critical fluid thermal equilibration experiment will be flown in conjunction with European-built experiment hardware.

Solid Surface Combustion Experiment

To help improve fire safety in space travel, the Solid Surface Combustion Experiment (SSCE) will study how flames spread in the absence of gravity.

The SSCE hardware has been designed to measure the flame shape and rate of flame spread in the absence of gravity-induced air flows and buoyancy effects.

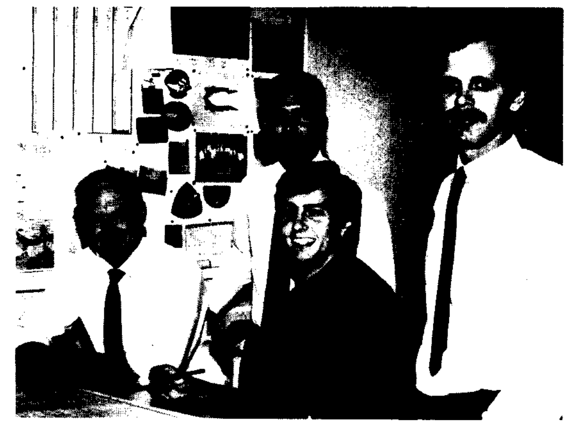
Initially, the experiment will burn paper. In later experiments, a thicker, plastic material will be used as fuel.

In addition to being flown on USML-1 in 1992, the SSCE hardware being developed at Lewis will be flown on as many as four shuttle missions in 1990 and 1991.

The SSCE project team includes management, engineering and scientific personnel from the Space Experiments Division, with support from Sverdrup Technology, Inc., and the Test Installations Division.

The principal investigator is Robert Altenkirch, professor of Mechanical Engineering at Mississippi State University.

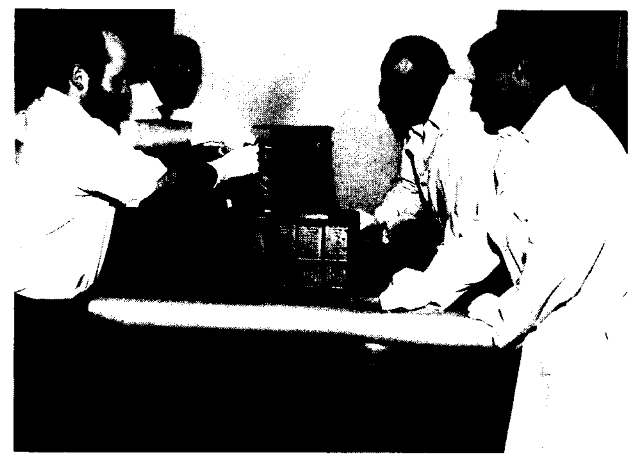
SSCE Project Manager Ralph Zavesky, left, evaluates data from zero gravity facility tests with Kurt Sacksteder and SSCE Project Scientist Sandra Olson.



Mechanical designer Neil Rowe, left, goes over the details of the SSCE hardware with (left to right) mechanical engineers David Haydu (Sverdrup), Bill Foster, and John Merry (Sverdrup).

Mechanical engineer Angel Otero, right, performs a SSCE flight crew procedure. Left to right: Flight technician Dan Haas and SSCE Deputy Project Manager John Koudelka verify his steps.

Left to right: Jim McKim (Sverdrup), Mark Brezenski (Sverdrup), and Dan Vento discuss SSCE software functions.



Electrical engineers Mike Brace, left, and John Sturman, second from left, record the pressure transducer voltage. Looking on are flight technicians Gary Gorecki, second from right, and Tom Hudach.

Space Acceleration Measurement System

The Space Acceleration Measurement System (SAMS) will serve a wide variety of space experiments. It is intended to fly on every shuttle mission that carries a microgravity science experiment. The first SAMS flight unit is scheduled to be launched on STS-40 in August.

A system of measuring and recording acceleration is needed because the results of many highly sensitive microgravity experiments can be disturbed by the residual gravity or vibration caused by even very low-level accelerations.

SAMS can monitor three locations or experiments simultaneously. The system will measure accelerations directly at the experiments through the use of three-axis acceleration sensors that are remote from the SAMS main electronics and data storage package.

In most cases, SAMS will provide acceleration data to interested principal investigators after the mission. But some of the SAMS data can be transmitted to Earth and analyzed with experiment data during the flight.

SAMS was designed for installation either in the shuttle middeck, the cargo bay (on the USMP missions), or the Spacelab module (on the USML missions).

Space Experiments Division personnel are managing the SAMS project, with help from Sverdrup engineers. SAMS hardware is being assembled and tested at Lewis with the support of the Test Installations Division.

LEFT ABOVE: SAMS team members from Sverdrup use high-powered workstations to design equipment and software and to store and process data. Left to right: Brian Finley, Louis Chestney, Steve Voit (seated), Jim McKim and Susan Fay.

ABOVE RIGHT: SAMS engineers discuss a proposed change to the design of the cargo bay configuration for the USMP-1 mission. Left to right: Bill Shiley (Sverdrup), Tibor Lorik (Sverdrup), Richard DeLombard (SAMS project manager), and John Heese (Sverdrup).

RIGHT: Integration and design information is controlled through MSFC-required documents and extensive databases prepared by (standing, left to right) Dave Allen (Sverdrup), Linda Parker (Sverdrup), Poppy Kalis, Susan Fay (Sverdrup), and (seated) Steve Hegg (Sverdrup).

Neil Rowe, left, inspects the first SAMS flight unit which will be flown on the SLS-1 mission. Assisting him are, left to right: SAMS Deputy Project Manager John Koudelka, John Thomas, Bill Foster, and Jim Kolibas (Sverdrup). Not shown: Larry Wald.

SAMS engineers from Sverdrup prepare for a performance test of the USML-1 flight unit. Preparing the flight unit (left) are, left to right: Dave Allen, Don Priebe, Mike Korba (Sverdrup Team Leader), and Tim Gobeli. Shown with the ground support equipment are: Bob Fitzgerald and Bart Gruber (right).

Test Installations Division supervisor Jerry Pamer, second from left, discusses work flow priorities for fabricating the next seven SAMS flight units. Technicians looking on are, left to right: Dan Haas, Gary Gorecki, Carl Costanzo, Minh Lam (Cuyahoga Community College Co-Op) and Tom Hudach.

Surface Tension Driven Convection Experiment

The Surface Tension Driven Convection Experiment (STDCE) will study how liquids behave without the presence of gravity.

On Earth, convection currents cause mixing in liquids, such as molten metals and crystal growth solutions. In the microgravity environment, this buoyancy-related mixing is eliminated. But potentially dramatic improvements in space-processed materials may be limited by flows and mixing caused by surface tension.

Professors Simon Ostrach and Yasuhiro Kamotani of Case Western Reserve University have proposed a space experiment to examine surface tension driven flows in microgravity.

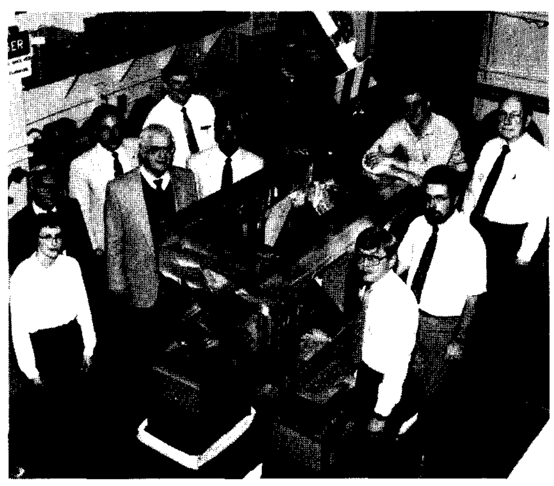
The experiment, to be conducted aboard USML-1, will use silicone oil with a free surface in a container, four inches in diameter and two inches deep. A sheet of light will be used to illuminate and observe the bulk flows caused by heating the surface.

The STDCE hardware, which will occupy a double Spacelab rack, is being designed and built at Lewis. The hardware will include four major components being developed under contract: an infrared imager to measure surface temperature, a CO2 laser to heat the oil surface, a laser diode to provide a light sheet, and a low light level video camera to record the convective flows.

The Engineering Directorate is coordinating the hardware development for the Space Experiments Division with design help from Aerospace Design and Fabrication (ADF, formerly W.L. Tanksley), and fabrication and testing support from the Fabrication Support and Test Installations Divisions.

To qualify the design for Spacelab, two engineering models are being built and tested. One model will be used to verify that the hardware functions as designed. The other model will verify the hardware's ability to survive launch vibrations.

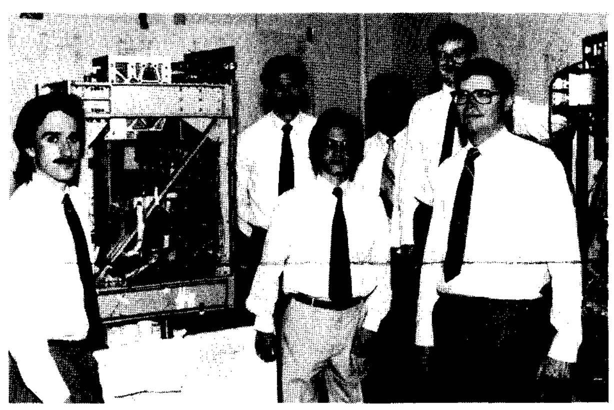
The STDCE project managers meet weekly with the lead engineers and key support personnel. Seated left to right are Sandy Walters, Tom Cressman, Jim Travis, Joyce Wanhainen, Ed Takacs, Carl Wendt, Len Miller (ADF), Frank Brady, Tom Legeza (ADF), Bill Coho, Clayton Meyers, Dennis Rohn, Tom Jacobson, and Jim Meyer. Standing left to right are Joe Berki (Analex), Frank Barina, Bob Boyle (Analex), John Woloschak, Alex Pline, Larry Green, Ed Satmary (ADF), Dave Petrarca, and Scott Numbers. Missing are Phil Kramer, Carl Fritz (ADF), Dennis Raible, and Georgette Miller.



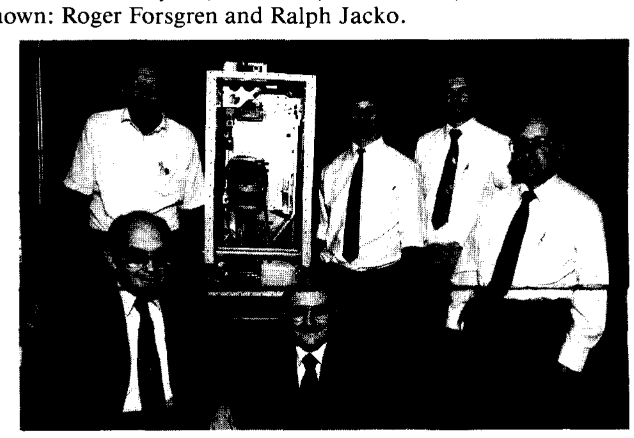
ABOVE LEFT: The Systems Integration and Analysis team is assembling the experiment systems and conducting integrated systems tests. For example, the team vibrationally tested the experiment packages to determine their response to shuttle launch loads. Left to right: Team leader Joyce Wanhainen, Ed Takacs, Dennis Rohn, Joe Fiala (Analex), Bob Yeager (ADF), Derrick Cheston, Ron Shaw, Chris Wisbar, Bill Scott (ADF), Tom Sutliff, and Eric Olsen. Not shown: Ed Ziemba (Analex) and Shelly Everett.

ABOVE RIGHT: Technicians supporting the assembly and wiring of the STDCE experiment and avionics package include: (clockwise) Foremen Jerry Pamer and Ed Kostyack, Jim Fleet, John Snead, Bob Seitz, Bob Paulen, Bill Ratvasky, and Andy Marlow. Not shown: Roger Forsgren and Ralph Jacko.

The STDCE mechanical engineering team is developing the test chamber and the cartridge heater system components of the experiment package. Left to right: Frank Jasko, John Combs (ADF), Bob Navarro, Ben Solis, Miguel Polanco, Larry Cola (ADF), Clayton Meyers, and Dave Petrarca. Not shown: Li Chang and Bob Patel (ADF).



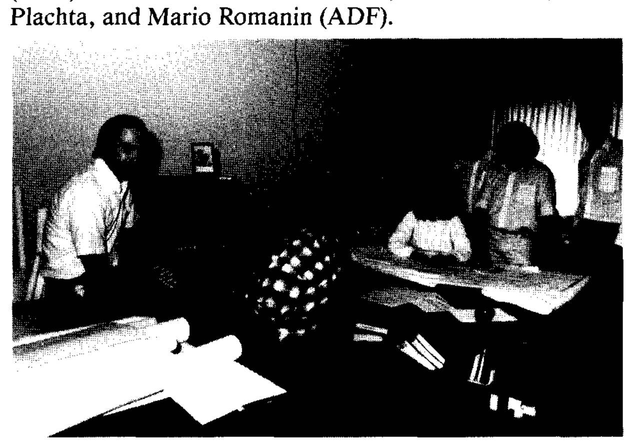
The STDCE structural engineering team is developing the structural framework for the experiment and avionics packages and ground support equipment. Left to right: Mike Pounds, Steve Elgin, Allen Siu, Dave Nawrocki, Jeff Chambers, and Tom Cressman.



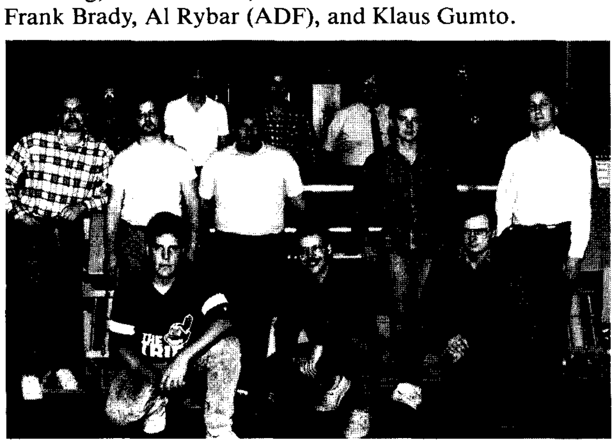
The STDCE fluid systems engineering team is developing the silicone oil transfer system and the water cooling system for the experiment package. Standing left to right: Al Hahn, Bruce Frankenfield, Eric Carlberg (ADF), and Bill Scott. In front: Rod Berriker (ADF) and Barney Bellagh (ADF). Not shown: Max Azzalini, Ed Mathiott, Dave Plachta, and Mario Romanin (ADF).

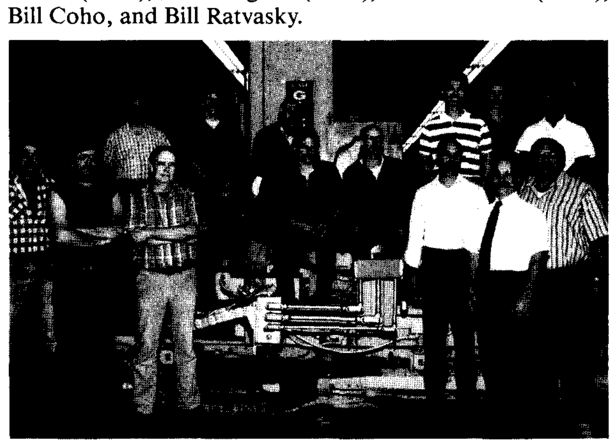
The STDCE electrical engineering team is developing the electrical, electronics, and software control systems for the avionics package. Left to right: Sylvia Yang, Dennis Eichenberg, Bob Dolesh, and Carl Wenzler. Not shown: Frank Brady, Al Rybar (ADF), and Klaus Gumto.

The STDCE optical systems will allow lasers to be precisely focused and use fiber optics for observation. Left to right: Tricia Martin (Analex), Nora Bozzolo (Analex), Dave VanZandt (ADF), Tom Legeza (ADF), Don Buchele (ADF), Bill Coho, and Bill Ratvasky.



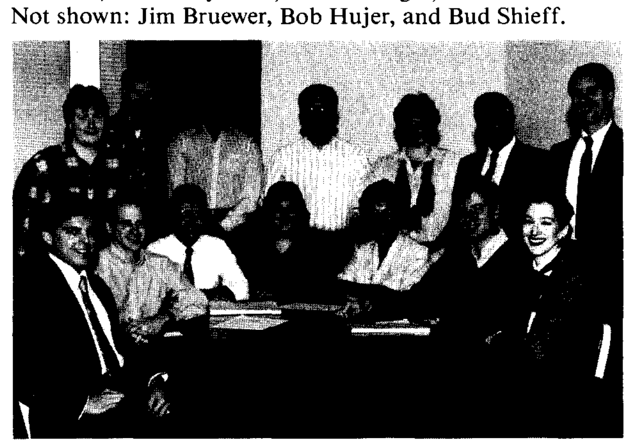
Most of the 400 drawings for STDCE were produced by designers at ADF (formerly W.L. Tanksley) using the CADAM system. Left to right: Mike Henry, Don Pucci, Debbie Zahs, Mike Hoychick, Jim Imburgia, and Paul Lesiak. Not shown: Jim Bruewer, Bob Hujer, and Bud Shieff.





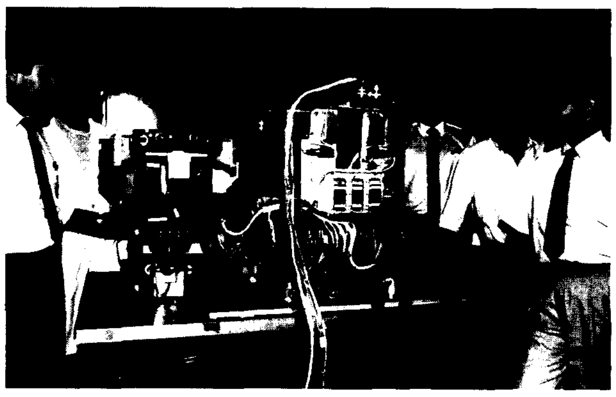
ABOVE LEFT: Employees of the Fabrication Procurement, Metal Fabrication, and Model Development Branches helped develop the STDCE engineering model. Standing, left to right: Randall Kwasny, Clifton Oskins, Ron Koenig, Thomas Gugliotta, Robert Kohler, Helmut Simonis, Daniel Kocka, Mike Lelak, and Robert Hauer. In front, left to right: Len Cramer, Bob Reminder, and Thomas Dixon. Not shown: Joe Kerka, Dan Gura, Elmer Bartels, and Don Sulak.

ABOVE RIGHT: Machine Shop personnel helped with machining, research instrumentation, and inspection of the STDCE engineering model. Front, left to right: Ray Kelly, Chuck Smalley, Scott Dorrance, Dan Buttler, Gus Scarpelli, and Andy Benek. Back row, left to right: Myron Joseph, Erik Faykus, Elmer Petelka, Frank Kmiecik, Wally Hendricks, Tom Vannuyen, Greg Blank, and Kenny Guinta. Not shown: Carl Blaser, Al Blaze, Stan Jopek, Richard Meden, Keith Raymond, and Nick Wolansky.



Procurement personnel prepared contracts to expedite the development of lasers and video cameras for STDCE. Print Shop employees printed many lengthy requests for proposals. Seated, left to right: Ernie Mensurati, Mike Lewis, Bob Butcher, Patti Hutka, Betty Brown, Bill Thompson, and Virginia Wycoff. Standing, left to right: Pat Hanrahan, Tom Plumlee, Leonard Vandiver, John Figula, Patty Figula, Steve Stefka, and Tom Tokmenko. Not shown: Bill Coho.


Laurie Levinson, center, and Denise Burns (Sverdrup) are developing the IDGE mission software with support from Ed Winsa, IDGE project manager and system designer.


The IDGE mechanical systems were designed and fabricated by (left to right) Jim Robertson, (Sverdrup), Gary Thomas, Kevin Romine (Sverdrup), Dave Vachon (Sverdrup), and Jerry Pamer. They are shown with the engineering unit.


The IDGE optical systems, both photographic and slow scan television, were designed and fabricated by (left to right) Howard Slater, Andy Fedak (Sverdrup), and IDGE Deputy Project Manager Jerry Kraft.

Isothermal Dendritic Growth Experiment

The Isothermal Dendritic Growth Experiment (IDGE) will test the mathematical models that predict metallic dendrite growth velocity and tip radius in a solidifying metal melt. Dendrites are whisker-like growths similar to structures found in snowflakes.

Dendritic growth is an important feature of solidification, with implications for the strength of castings.

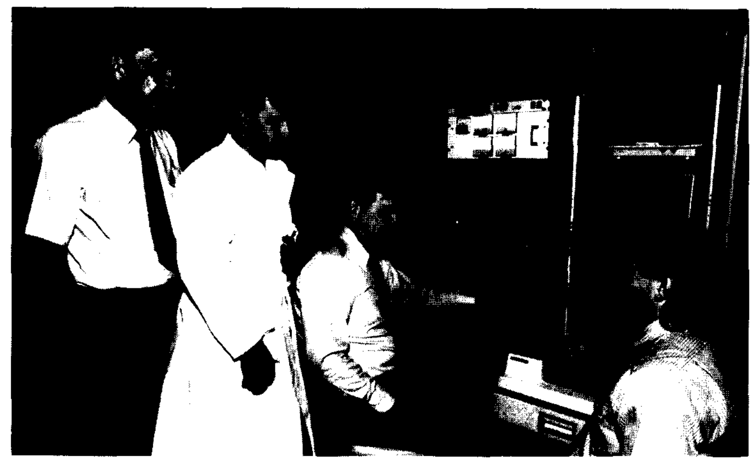
By verifying or correcting the existing models of predicting metallic dendritic growth, the IDGE could lead to improved techniques for commercial production of steel, aluminum, and superalloys.

The growth chamber in the IDGE apparatus contains succinonitrile, an organic compound that solidifies similarly to iron and steel. Because succinonitrile is transparent, the characteristics of the dendritic growth process can be observed and photographed. The growth chamber is contained within an isothermal bath designed to control the required temperatures to within two-thousandths of a degree.

The IDGE apparatus will operate autonomously and transmit data to Earth during operations in orbit.

The principal investigator is Professor M.E. Glicksman of the Rensselaer Polytechnic Institute. A team of Lewis and Sverdrup employees are designing, developing, and testing the IDGE apparatus.

Currently, the IDGE hardware development models are being tested and flight hardware is being procured. IDGE is planned for the USMP-2 mission in February 1993.


The IDGE electronic systems were designed and fabricated by (left to right) Don Priebe, (Sverdrup), Tom Hudach, Dick Abramczyk (Sverdrup), and Jim McDade (Sverdrup). They are shown with the IDGE Experiment Checkout Equipment.

Critical Fluid Light Scattering (Zeno) Experiment

The Critical Fluid Light Scattering Experiment (dubbed Zeno in honor of an ancient Greek philosopher) will study the density fluctuations of xenon at temperatures very near the critical temperature for the vapor/liquid phase transition of this ideal fluid. Zeno will use dynamic light scattering spectroscopy and correlation analysis.

The experiment will test theories describing vapor/liquid phase changes in realms that are of great interest to fluid physicists. For example, current theories predict dramatic changes in dynamic properties such as compressibility, thermal conductivity, heat capacity, and viscosity. But to date, these theories have been inadequately tested at the temperatures of interest.

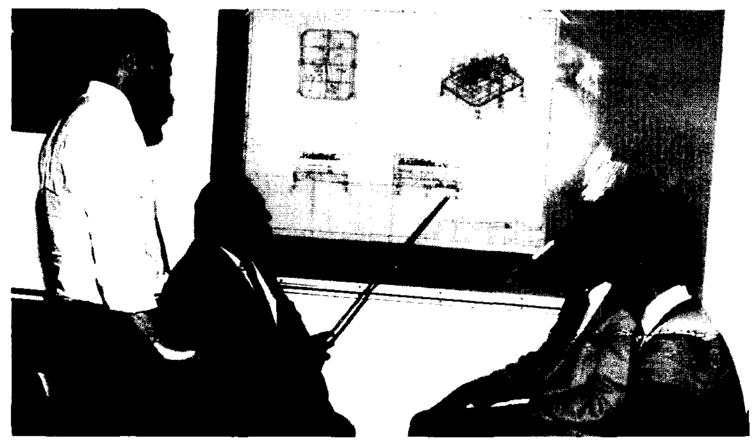
Such measurements are severely limited on Earth because normal gravity creates large density gradients in the fluid.

Zeno is expected to have a far-reaching impact, because the theories it examines provide "universal" descriptions of many transitions such as ferromagnetization and superconductivity.

The principal investigator is Professor R.W. Gammon of the University of Maryland. Under contract to NASA, his eight-member team will define and implement the science requirements and develop the flight instrument. The flight hardware engineering, fabrication, and integration/testing has been subcontracted to the Ball Aerospace Group, Boulder, CO.

The Space Experiments Division (SED) is providing project management and scientific oversight for the experiment. Technical oversight is matrixed from the SED and the Engineering Directorate. The Office of the Comptroller is providing contract and financial management.

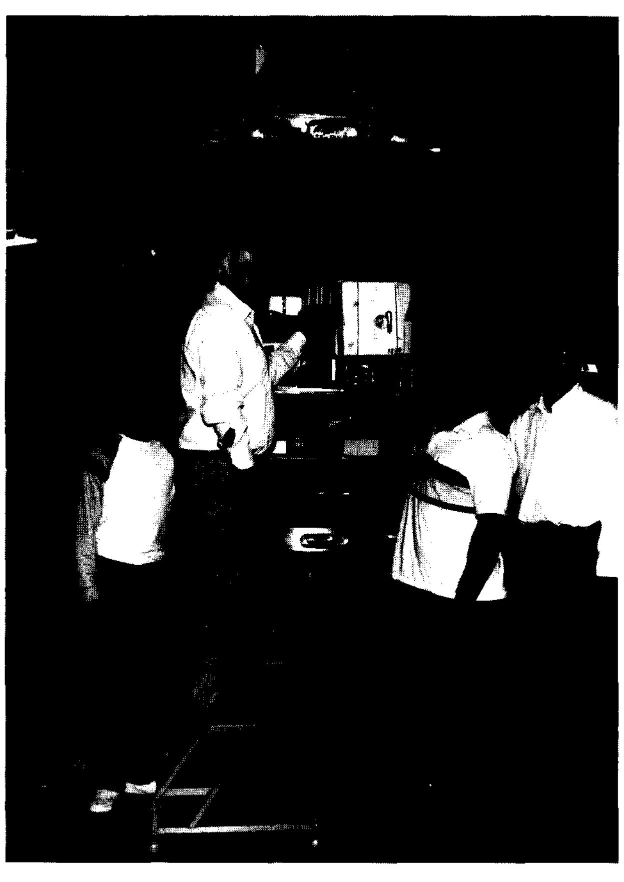
Zeno will be launched on USMP-2 in March 1993.



ABOVE: The Zeno Engineering Oversight Team reviews technical input from hardware contractors. Left to right: Paul Tavernelli, Marty Kisel (Analex), George Smolak (Analex), and Paul West. Not shown: Carlos Grodsinsky and Klaus Gumto.

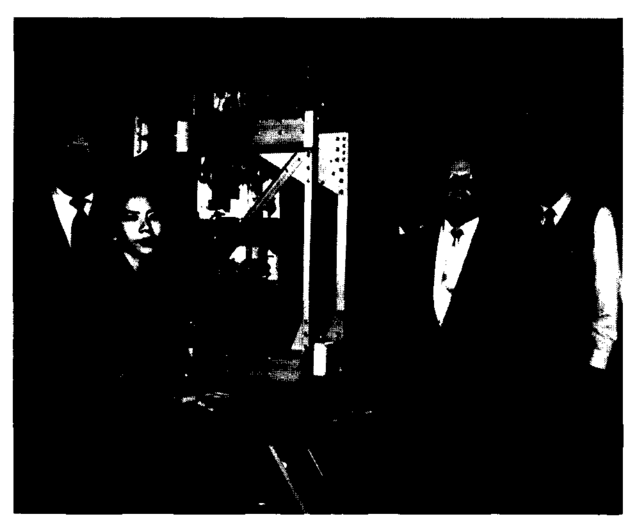
LEFT: The Zeno Project Management Team oversees science and contracted activities. Left to right: Project Scientist Alan Wilkinson, Contract Manager Eugene Schiopota, Deputy Project Manager Nancy Shaw, and Project Manager Richard Lauver.

Ground Testing And Mission Safety And Assurance



ABOVE: Employees from the Office of Mission Safety and Assurance review the safety and verification requirements for the flight experiments. Seated, left to right: Dan Morilak, Irene Bibyk, and Vince Lalli. Standing, left to right: Cody Williams and Chi Yeh. Not shown: Larry Greene (Analex) and Carl Weegman.

LEFT: A Zero Gravity Facility team supports several of the USML and USMP Flight experiments by conducting microgravity tests in the Zero Gravity Facility and on the Learjet. Front row, left to right: Norm Fallert, Leo Robinson, Team Leader Ray Sotos, Jack Kolis, and Eric Neumann. Back row, left to right: Carl Richley and Joe Wilson. Not shown: Al Shott. The team is shown with a pool boiling experiment installed in a typical drop vehicle.


Office of Mission Safety and Assurance personnel establish and monitor quality assurance and materials and process requirements for in-house experiments. Left to right: Robert Bryan (Analex), Kim Pham, Henry Haller, Scott Numbers, Frank Barina, and Dan Williston (Analex). Not shown: Joe Berki (Analex).

Team Lead: Richard Parker
Awareness Lead: Jimmy Simek
Photographer: Angela Coyne

Surface Tension Driven Convection Experiment

By Jim Meyer

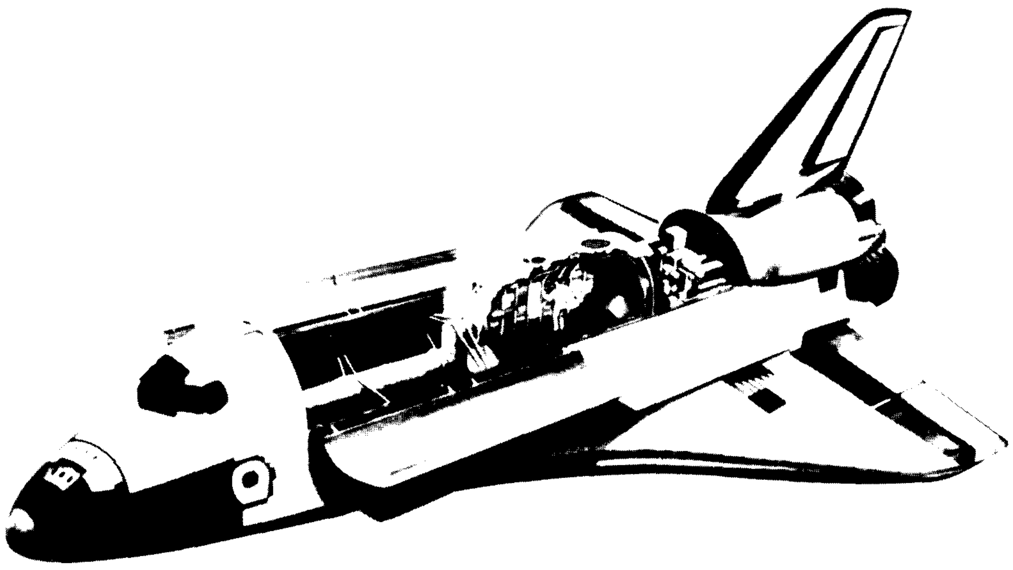


Figure 1

The shuttle will carry the Spacelab Module and the STDCE hardware to a specified orbit and attitude in the second quarter of Calendar 1992. The module will remain in the shuttle's cargo bay and will be occupied by the crew throughout the 13 day mission. During this time, the experiment will be one of several operated by this crew.

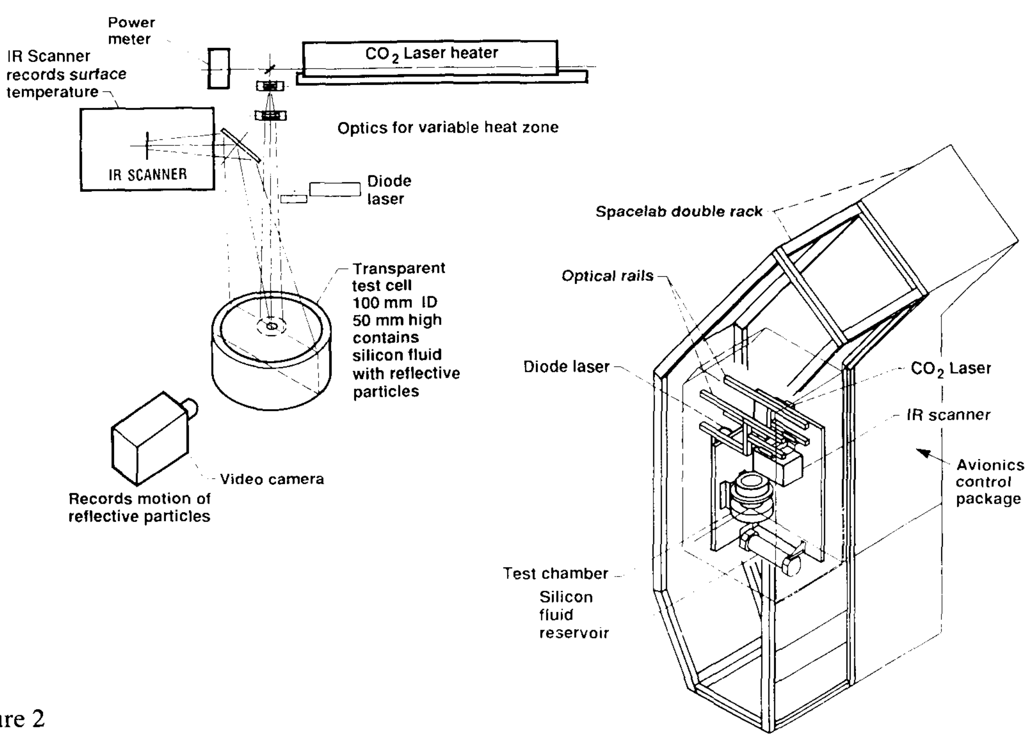


Figure 2

THE HISTORY

Over the last six years, the Lewis Research Center has become a major participant in the NASA Microgravity Science and Applications Program. Although many challenging experiments have been undertaken by the Space Experiments Division, one has recently caused a significant commitment to be made by the Lewis Research Center to the Associate Administrator for Science and Applications at NASA Headquarters: to deliver the flight hardware for a Surface Tension Driven Convection Experiment (STDCE) for the first United States Microgravity Laboratory mission (USML-1) presently scheduled to fly in March 1992 in a Spacelab onboard the space shuttle (see Figure 1).

The STDCE development project is an in-house effort utilizing a matrix approach in the design, fabrication, assembly and testing of a complex experiment apparatus. The center director, Larry Ross, has given priority to delivering the flight qualified hardware to KSC for integration into a Spacelab double rack. The commitment, made initially by John Klineberg in August 1988, has resulted in an intense effort to complete a difficult development project while meeting a fixed flight schedule. This has provided a unique challenge for Lewis employees.

The intent of this article is to increase awareness of the tremendous response made by the Engineering Directorate (ED) personnel in their design of the STDCE and by all other personnel in the Procurement Division, the Fabrication Support Division, the Work Control Office, and the Test Installations Division in their support of this intense effort managed by the Space Experiments Division with assistance from the Office of Mission Safety and Assurance. This effort required the cooperation of many people dedicated to working both "hard" and "smart" to complete tasks on schedule while absorbing new requirements imposed by the Spacelab, managed by Marshall Space Flight Center (MSFC), and the stringent "paper trail" of documentation required for manned spaceflight projects.

The project started as a simple experiment proposed by Professors Simon Ostrach and Yasuhiro Kamotani of Case Western Reserve University (CWRU). In the mid-seventies, the reduced gravity environment in Earth orbit had been considered ideal for materials processing, such as crystal growth and alloy solidification, because convection flows due to buoyancy were reduced. Dr. Ostrach pointed out, however, that convection flows in liquids were still present in low-gravity due to the effects of surface tension.

In 1980, Dr. Ostrach proposed a low-gravity demonstration of surface tension driven convection caused by a temperature variation on the surface of an oil. By heating from above, the hot spot would have its surface tension reduced and the fluid would be pulled by the cooler surrounding surface with a higher surface tension. This surface flow causes a bulk flow in the fluid which can disrupt materials processing in space.

In response to requests by Science Review Board members, by March 1985 this simple demonstration became the Surface Tension Driven Convection Experiment (STDCE): a series of three flights of two hours each, with the hardware located in a double locker on the space shuttle's mid-deck. Tom Jacobson became the STDCE Project Manager and, in November 1985, conducted a successful Conceptual Design Review. The STDCE was judged desirable by the Science Review Board, composed of leading experts in fluid mechanics, and approved for concept development by the Microgravity Science and Applications Division at NASA Headquarters.

The Space Experiments Division initiated the STDCE project at Lewis by requesting a Technology Study by the Engineering Directorate in March 1986. The effort of five full-time engineers was first managed by Phil Kramer and later by John Woloschak. These studies resulted in a redefinition of the experiment and a final Science Requirements Document requiring two flights of six hours each in a Spacelab.

In February 1988, after a successful Requirements Definition Review, the STDCE project received approval to begin the flight experiment development effort based on a projected completion of hardware by February 1991. The STDCE project team was expanded to 30 engineers to complete the preliminary design of the apparatus which had then been reassigned to a single Spacelab rack: the Experiment Package, housing the mechanical and optical components in the lower part, and the Avionics Package, housing electrical and electronic control and instrument components in the upper part.

In May 1988, the design was reviewed by mission specialist/astronaut Bonnie Dunbar, who recommended more participation by the Spacelab crew in operating the experiment. This changed the direction of the design effort made to that point.

Procurement was initiated in September 1988 for the development, under contract, of a CO2 laser for oil heating, a laser for particle illumination, a video camera, and an infrared imager.

The Preliminary Design Review for STDCE was successfully conducted in December 1988. The fabrication of two engineering models was approved: one for vibration testing, to check the design adequacy in withstanding launch vibrations, and one for functionality tests, to check operational reliability after

(continued)

The Lewis Team That Is

CWRU SCIENTIFIC INVESTIGATION

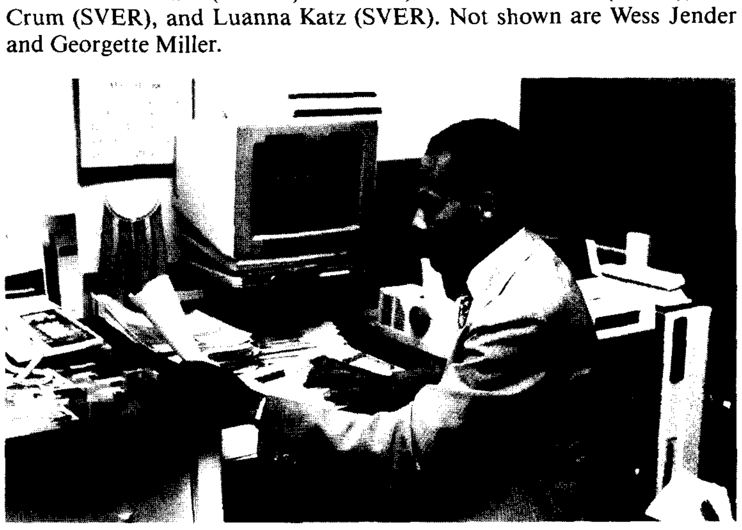
Developing the science objectives of this experiment has been the job of the Principal Investigators (PI's) at Case Western Reserve University, and their counterparts at Lewis. Shown are PI's (L to R) Robert Thompson, Tom Jacobson, Simon Ostrach (CWRU) and Yasuhiro Kamotani (CWRU).

STDCE PROJECT MANAGEMENT

The Lewis Research Center STDCE Project Management Team has been responsible for obtaining necessary funding and maintaining the liason between Lewis, the PI's, NASA Headquarters and other Centers involved in the mission. Shown are (L to R) Fred Kohl, Tom Jacobson, Jim Cake and Bob Thompson.

RESOURCES MANAGEMENT

The ED engineering and design manhours and the funding required to undertake and complete this effort are very substantial. Keeping track of these resources, both previously used and presently available, is the responsibility of the Engineering Support Division headed by Earl Bloam. Shown are (L to R) Al Pucci, Chris Baldassari (SVER), Pat Crum (SVER), and Luanna Katz (SVER). Not shown are Wess Jender and Georgette Miller.



MANAGEMENT AND PROJECT SUPPORT

The task of managing the project would be much more difficult without the support received from the FOD Managment and Project Support Office headed by Bob Thomas. The enormous number of purchase requests, schedules, etc. must be tracked, expedited, updated and otherwise put into a database to be available to all project team members as needed. This has been the primary assignment of Jim Travis and Sandy Walters. Pictured is Jim Travis.

conducting thermal and electrical tests.

In June 1989, weight increases in the Avionics Package required a relocation of the STDCE into a Spacelab double rack. Also, a "glove box" concept was developed to allow access for recovery from an oil spill within the experiment test chamber during the flight. In August 1989, the Lewis commitment to the USML-1 mission was reaffirmed, but made with a strong awareness of the high risk in the success-oriented schedule and the reliance on contractors to deliver the key components on schedule. Also, the effort was increased to its current level of 56 engineering and support personnel in ED, now managed by Jim Meyer and Dennis Rohn.

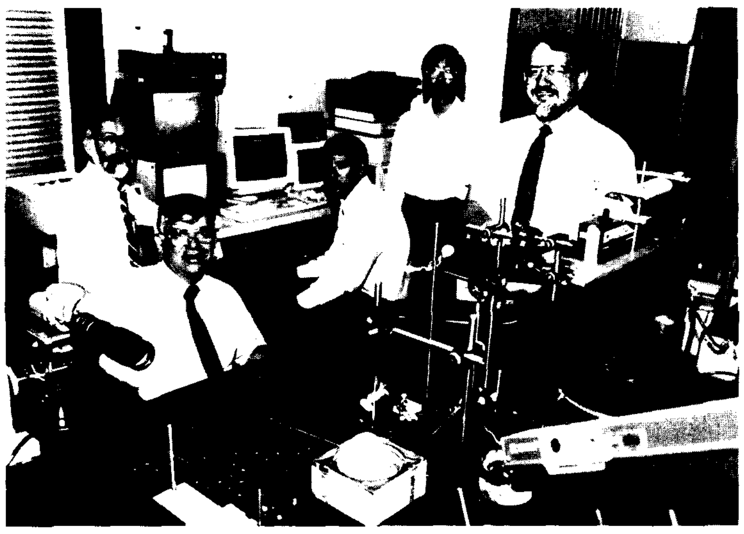
The two Engineering Models were fabricated and assembled at Lewis in 1989 with exceptional support from Procurement, Fabrication, and TID personnel. The results from vibration and functional tests mandated additional design changes. A Critical Design Review was held in December 1989 and a Delta-CDR was just completed in October 1990 to review all the design changes and final test results. Most of the flight hardware was fabricated during the past summer and is now (November 1990) being assembled and wired, prior to beginning a very ambitious testing program.

THE EXPERIMENT

In the STDCE apparatus (see Figure 2), a circular container (10 cm diameter and 5 cm deep) is filled on-orbit with silicone oil into which small seed particles are mixed. The oil will form a spherically-curved surface, the shape liquids assume when gravity forces become small. Once the container is filled, the liquid is "pinned" by the edges of the container and a flat surface is formed. The oil surface is then centrally heated by focusing the radiation from a CO2 laser (operated at several power levels) to conduct constant flux tests. Constant temperature tests are then conducted by inserting a submerged cartridge heater into the container.

The resulting thermocapillary oil flow is measured using a video recording of the movement of the seed particles in the oil. The velocity distribution is correlated with the surface temperature distribution, measured by a scanning infrared imager. The correlation is then compared to computed results from a numerical model of the experiment developed at CWRU.

On the first flight, tests will (a) verify the "model" and (b) increase the driving force (temperature gradient) high enough to induce oscillation in the



LEWIS SCIENTIFIC INVESTIGATION

Research has been conducted at Lewis to develop experimental techniques to help realize the science objectives. This development has been done through the use of various lab bench test programs. Lewis investigators shown, (L to R) Duane Rost (Youngstown State), Bob Thompson, Alex Pline, K. C. Hsieh (SVER), and Tom Jacobson.

ENGINEERING MANAGEMENT

The Engineering Directorate has, in many instances, assumed the role of the "general contractor" in that its personnel "follow-up", "integrate", "coordinate", "specify", "schedule" and "document" the activities of the many parts of the project team, as well as perform the design engineering and drafting. Such has been the case for the STDCE Project. The leadership for those many tasks must come from the Engineering Management Team whose responsibility it is to insure the meeting of a demanding schedule with a fixed end date.....the flight of USML-1. Seated are (L to R) Ed Satmary (ADF), Joel Knapp (Analex), Dennis Rohn, Deputy Eng. Mgr., Jim Meyer, Eng. Mgr., Tom Legeza (ADF). Not in the picture are Mary Quillian, Ray Kaliszewski (ADF), Carl Fritz (ADF), Len Miller (ADF) and Paul Lesiak (ADF).

CONTRACT MANAGEMENT

Several major contracts have been let to provide critical optical system components such as an infrared imager and CO2 and "diode" laser systems. The management of these contracts has played a significant role in the project. Procurement Division Space Systems Branch personnel on the team are headed by Ron Everett, chief. Shown are (L to R) Tom Tokmenko, Virginia Wycoff, Chris Signorino, Ernie Mensurati and Debra Rak. Missing from the group are Ron Everett and Gary Golinski.

Also in the Management and Project Office are (L to R) Sandy Walters and Bob Thomas.

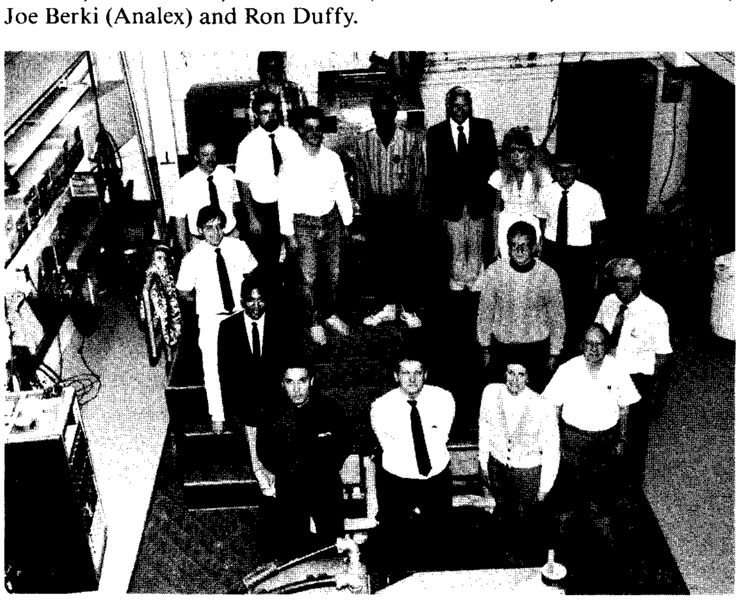
Making STDCE Happen

MECHANICAL AND FLUID SYSTEMS DESIGN

The design of the complex oil and water systems, as well as the all-important test chamber, has been the responsibility of the mechanical and fluid systems design team headed by Principal Engineer Dave Petrarca and Deputy Clayton Meyers. Kneeling are (L to R) Don Pucci (ADF), Ben Solis, Barney Bellagh (ADF), Robert Navarro, Reza Zinolabedini (ADF), and Bruce Frankenfield. Middle Row (L to R) Bob White (ADF), Larry Cola (ADF), Edye Stewart (ADF), Debra Zahs (ADF), Henry Frimel (ADF), Bob Patel (ADF), Mike Henry (ADF), Hope Kosmidis (ADF), Tom Fotta (ADF), and Ed Mathiott (Analex). Back Row (L to R) Mike Hoychick (ADF), Jim Imburgia (ADF), Paul Lesiak (ADF), Burt Smith (ADF), Earl Anderson (ADF), Dave Petrarca, Clayton Meyers, Rod Berriker (ADF), and Dave Plachta.

CONTROL AVIONICS DESIGN

Control of the experiment (both automatically and by the payload specialist) is achieved by using a state-of-the-art avionics system housed in a companion package to that containing the experiment itself. Its functions include providing the necessary pre-programmed control "logic"; i.e., safety shutdowns, interlocks, and operating sequencing to insure a successfully run experiment. Shown is the Avionics Design Team headed by Principal Engr. Frank Brady. (L to R) are Sylvia Yang, Eric Olsen, Frank Brady, Pat Montgomery (SAIC), Cliff Hausmann, Dave Nawrocki, Dennis Eichenberg, and Bill Espinosa. Not pictured are Carl Wenzler, Bob Dolesh, Mike Lichter, Glenn Williams, Dave Stevenson, Joe Berki (Analex) and Ron Duffy.



SYSTEM INTEGRATION

As the specialized design, test and hardware fabrication efforts end, the task of assembly and checkout of the flight hardware begins. This is the responsibility of the Systems Integration and Analysis Team headed by Principal Engineer Joyce Wanhainen. Standing are (clockwise) Joyce Wanhainen, Jim Robinson, John Siamidis (Analex), Derrick Cheston, Jim Yuko, Dennis Rohn, Tom Stuliff, Ron Shaw, Chris Wisbar, John Huff, Ed Takacs, Shelly Everett, Eric Olsen, Tom Doehne, Joe Fiala (Analex) and Bill Scott (ADF). Missing are Ed Ziemba (Analex), Baxter Beaton (Analex), Al Hahn, Bob Horak, Jack Oram, and Tony Johnson (Analex).

temperature and velocity data. These oscillations are not possible to predict numerically and difficult to produce experimentally. However, they can negate the benefits of in-space material processing. On a second flight, tests will be conducted to quantify the onset and extent of the oscillations.

THE ENGINEERING

Besides meeting all science goals, the STDCE hardware designs had to accommodate rigorous weight and physical size limitations. The design engineers were requested to verify the suitability of these designs by testing engineering "models" especially constructed to duplicate the proposed flight hardware in every essential detail, and finally, to oversee the fabrication, assembly and checkout of the actual flight hardware prior to shipping to Kennedy Space Center in the second calendar quarter of 1991.

The success of any engineering task requiring a multi-disciplined effort, such as the STDCE project, is greatly dependent upon establishing an organization, providing the means to effectively communicate between all members of it and in determining exactly what is required to get the job done! Also required was the dedication of team members with varied experience levels applied to what has, on various occasions, proved to be an almost overwhelming task. This dedication was essential because of Lewis' committment to a very tight schedule and the project being the first such space flight package design/build effort of this complexity done "in house" at Lewis in many years.

A significant amount of learning was required with the many technical problems encountered, compounded by having to meet a highly success oriented schedule. This in effect required the design, testing and build efforts to proceed perfectly with no time allowed for any rework as may be needed. Since the likelihood of this occurring for every task was very slim, working "smart" became extremely important so that some "slack time" could be created in the schedule to allow for necessary "adjustments".

One of the many engineering and engineering management challenges has involved meeting the multitude of safety requirements which arose throughout the project's design phases and after. Not only application of engineering principles was involved but also the preparation of extensive documentation regarding all design and safety reviews, testing plans, operating procedures, types of materials used and verification of their qual-

STRUCTURES DESIGN

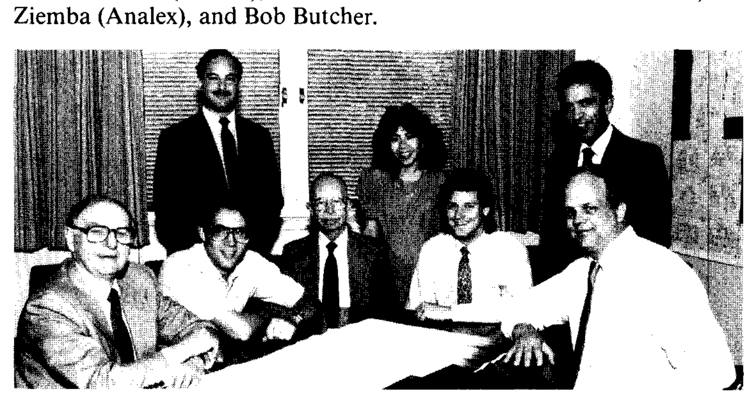
Designing the structures to safely contain the experiment and avionics hardware was the task of the Structures Design Team headed by Principal Engineer Tom Cressman. Front Row are (L to R) Jerry Lang, Allen Siu, Larry Cola (ADF), Debra Zahs (ADF), Reza Zinolabedini (ADF), and Mohamad Bachir (ADF). Middle Row are (L to R) Bob Patel (ADF), Elmo Farmer (Analex), Don Pucci (ADF), Mike Pounds, Marty Kisel (Analex), Ed Satmary (ADF), and Mike Jamison (ADF). Third row are (L to R) Warren Holt (ADF), Mike Holychick (ADF), Dave Nawrocki, Steve Elgin, Paul Lesiak (ADF), and Burt Smith (ADF). Missing from the photo are: Tom Cressman, Jeff Chambers, Paul Trimarchi, Jim Yeager, Mario Romanin (ADF), Steve Killmeyer (ADF), Al Kaufman (Analex), Jim Van Vleet (Analex), Harold Kasper (Analex), Eric Olsen and Fred Yarris.

CONTROL SOFTWARE DESIGN

Designing the logic programming required to effect the exacting control required for this complex experiment has been the task undertaken by the Software Design Team with Klaus Gumto as principal engineer. Shown are (L to R) Klaus Gumto and Al Rybar (ADF). Missing is Larry Feagan.

OPTICAL SYSTEM DESIGN

Obtaining of the science data is largely dependent on the performance of the optical system needed to detect particle motion, surface temperature of the fluid and in the control of the laser heating systems. The design team is led by Principal Engineer Bill Coho. Shown are (L to R) Dave Van Zandt (ADF), Don Buchele, Bill Ratuasky, Tom Legeza (ADF), Bill Thompson, Dennis Culley (ADF), Tricia Martin (Analex), Nora Bozzolo (Analex), and Bill Coho. Absent are Mike Lewis, Ed Ziemba (Analex), and Bob Butcher.



MISSION SAFETY AND ASSURANCE

Recent NASA history has mandated a greatly emphasized role for those individuals involved in the Office of Mission Safety and Assurance. It has been no less the case for this project. Those from the Office of Mission Safety and Assurance supporting this task are: seated (L to R) Frank Barina, Scott Numbers, Cody Williams, Dan Morilak, and Pat Montgomery (SAIC). Standing are (L to R) Larry Greene (Analex), Kim Pham, and Vince Lalli.

NASA Lewis Research Center

Lewis News

Volume 29 Issue 19 September 11, 1992

Mission Debriefing

USML-1 Astronauts Praise Experiments

During a special debriefing at Lewis on Aug. 19, Payload Specialist Dr. Eugene Trinh called the Surface Tension Driven Convection Experiment (STDCE) one of his favorite experiments aboard the Space Shuttle *Columbia* (STS-50), the first United States Microgravity Laboratory (USML-1) mission. "Even before I flew this apparatus I knew I was going to like it," said Dr. Trinh. "I was very lucky to have a good training team at Lewis and a good simulator to work with."

Lewis and Case Western Reserve University (CWRU) personnel are looking forward to collecting and analyzing the results of the data acquired during the 14-day mission. This Lewis-based experiment stemmed from theories on the low-gravity effects of surface tension, initiated by Professors Simon Ostrach and Yasuhiro Kamotani of CWRU, and was made possible through a team of Lewis scientists, engineers, and technicians.

Dr. Trinh also praised Dr. Joseph Prahl of CWRU, who served as alternate payload specialist, for his extensive ground-based support. Dr. Prahl joined the five astronauts here at Lewis during the debriefing.

"I was very lucky to have a good training team at Lewis and a good simulator to work with." USML-1 astronaut Dr. Eugene Trinh.

Mission Specialist Col. Carl Meade, who was also in attendance, talked about his work with Lewis' Candle Flames in Microgravity Experiment. Expected to provide answers to longstanding and common questions about flames in zero gravity, this experiment, contained in the Glovebox Experiment Module, produced candle flames for up to two minutes. Col. Meade also showed a slide of Lewis' Interface Configuration Experiment, which will help scientists confirm existing theories about the general shape and/or location of fluid surfaces in containers in space.

Later in the debriefing, Col. Meade narrated videotaped footage of the set-up of Lewis' Smoldering Combustion in Microgravity Experiment.

Of the 31 experiments flown on STS-50, seven were designed and developed by members of the Space Experiments Division (SED) and supporting organizations at Lewis. Four were designed to study combustion in space, which could lead to new methods of fire prevention and control in space, as well as here on Earth. Three experiments dealt with fluid dynamics and were designed to develop a greater understanding of fluid behavior in space and how space-based processing (e.g. crystal growth) is affected by that behavior. In addition, the instrumentation package to record acceleration levels in support of all the science of USML-1 was designed and developed by SED scientists and engineers.

Photo by Marvin Smith

USML-1 astronauts who conducted the debriefing at Lewis included: (left to right) Mission Specialist Dr. Bonnie Dunbar, Payload Specialist Dr. Eugene Trinh, Payload Specialist Lawrence DeLucas, Payload Specialist (alternate) Dr. Joseph Prahl, Mission Specialist Col. Carl Meade, and Commander Capt. Richard Richards.

Astronauts Trinh and Meade were joined by Capt. Richard Richards, mission commander;

Continued on page three

USML-1 Astronauts Visit Lewis

Continued from page one

Bonnie Dunbar, payload commander; and Dr. Lawrence DeLucas, payload specialist.

A proclamation titled "Recognizing the Crew and the Work Performed by Employees of NASA Lewis Research Center and others Aboard the Space Shuttle *Columbia* (STS-50)" from Cleveland Mayor Michael R. White was presented to William Masica, chief, Space Experiments Division.

Speaking on behalf of Lewis' involvement in the USML-1 mission, Howard Ross, chief of the Microgravity Combustion Branch, likened the mission to "a kind of personal Olympics for many of us at Lewis, where years of personal effort culminated in this singular occasion, and many days and nights during the mission, Lewis' experiments scored a perfect ten," he said.

Photo by Marvin Smith

Payload Specialist Dr. Lawrence DeLucas (left) autographs photographs for Howard Ross, chief of the Microgravity Combustion Branch (right).

STS-47 50th Shuttle Flight

Three Lewis Experiments Aboard Endeavour

The 50th shuttle flight, STS-47, marks the first NASA mission devoted primarily to Japan. The Space Shuttle *Endeavour* will carry a crew of seven, including a Japanese mission specialist, and the Spacelab-J (SL-J) science laboratory into Earth orbit. Lewis' Solid Surface Combustion Experiment (SSCE), marking its fifth flight aboard a shuttle, joins six others from the United States. Thirty-four Japan-provided experiments and two joint (U.S./Japan) experiments will also fly.

In the SSCE planned for STS-47/SL-J, scientists will test how flames spread along an instrumented filter paper sample in a test chamber containing 35 percent oxygen and 65 percent nitrogen at 1.5 atmospheric pressure. Ultimately, plans call for the SSCE to fly a total of eight times, testing the combustion of different materials under different atmospheric conditions.

Lewis' Pool Boiling Experiment (PBE) will also fly on STS-47. Aimed at improving the understanding of the fundamental mechanisms that constitute nucleate pool boiling, the PBE will accomplish this by conducting experiments in microgravity and, coupled with appropriate analyses, will investigate the heat transfer and vapor bubble dynamics associated with nucleation, bubble growth/collapse, and subsequent motion.

"We hope to learn how 113 (Freon) properties react in space during the boiling process," explained Angel Otero, project manager of the PBE, Space Experiments Division. "Depending on the results, we may be able to substitute 113 for the expensive cryogenics fluids." Otero noted that on this mission the quality of the prototype unit enables it to fly in place of the actual flight hardware. Appropriate modifications will then be made to the flight hardware for a follow-up flight.

The Space Acceleration Measurement System (SAMS), designed to measure and record low-level acceleration that the Spacelab experiences during typical on-orbit activities, will also be on board. SAMS flight hardware was designed and developed in-house by the Lewis and Sverdrup Technology project team.

Commander of the mission is Robert "Hoot" Gibson, making his fourth shuttle flight. Curtis Brown is making his first flight as pilot. Making their second shuttle flights are Mission Specialists Mark Lee and Jay Apt. First time space travelers are Mission Specialists Jan Davis and Mae Jemison. Jemison is the first African American woman to fly in space.

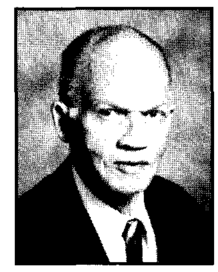
Exceptional Service Medals

NASA acknowledges Honor Award recipients

Twenty-eight Lewis employees were honored for exceptional service during the NASA Honor Awards Program on May 27. A total of forty-three Lewis employees were presented medals. Recipients are also featured on page four.


Block


Bollenbacher


Boyd


Chucksa


Corso


Duchoslav


Everett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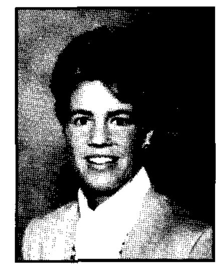

Griest

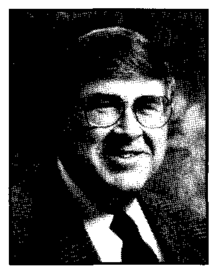

Gura


Horansky

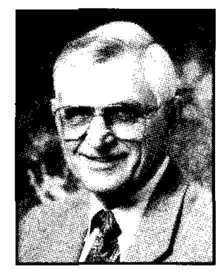

Kelly


Kotlenz


Lehota


Leonard


Nieberding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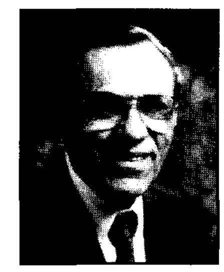
Puthoff


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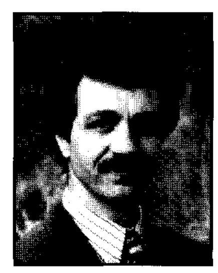
Romanchok


Schwarze


Scudder


Seeholzer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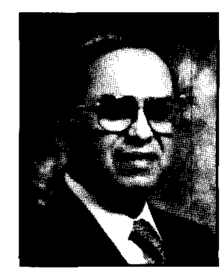

Simon

H. Bruce Block, deputy chief, Aeropropulsion Facilities and Experiments Division. For outstanding leadership in conducting in-house testing and developing associated facilities for the Lewis Aeropropulsion Program.

Gary Bollenbacher, Engineering Support Division. For innovations in software analysis and integration that contributed significantly to many successful launches of Lewis-managed launch vehicles.

Gilbert M. Boyd, Office of Environmental Programs. For exceptional contributions to research, environmental protection, and worker safety at Lewis.

Ronald J. Chucksa, Electronic and Control Systems Division. For outstanding engineering management contributions in support of aeronautics research and the development of space experiments.

Dianna H. Corso, chief, Computer Technology Branch, Procurement Division. For dedicated and effective procurement support to NASA and Lewis computer technology programs during a period of major changes in technology and procurement regulations.

Peggy S. Duchoslav, (posthumously), Technical Information Services Division. For consistently providing outstanding service and innovative solutions to the many customers of the Technical Information Services Division.

Ronald E. Everett, chief, Space Systems Branch, Procurement Division. For exemplary leadership of procurement professionals and significant and innovative contributions to the success of major space programs for Lewis.

Wilson F. Ford, chief, Office of Mission Safety and Assurance. For successfully establishing and developing a highly professional, proactive, and collaborative Safety, Reliability, and Quality Assurance Program at Lewis.

Robert J. Frye, deputy chief, Systems Development and Verification Branch, Electrical Systems Division. For many outstanding engineering contributions to the development of space power electronics.

Olga D. Gonzalez-Sanabria, Space Experiments Division. For outstanding contributions to the development and coordination of Lewis activities in the OAST In-Space Technology Experiments Program.

Debra L. Griest, chief, Development, Counseling and Management Services Branch, Human Resources Management Division. For outstanding performance in human resources development at Lewis and fostering employee involvement in total quality and multicultural work force issues.

Daniel V. Gura, Fabrication Support Division. For valuable innovations in model fabrication and exceptional dedication in training apprentices and cooperative education students.

Nancy A. Horansky, External Programs Directorate. For extensive knowledge and outstanding secretarial skills that have contributed significantly to the efficiency and effectiveness of the new External Programs Directorate.

Regina B. Kelly, Test Installations Division. For outstanding technical management of the Facilities Operation and Test Support Services Contract.

Pamela Kotlenz, Facilities Operations Division. For significant contributions to the security of the many diverse, automated information systems at Lewis and outstanding leadership in establishing security risk management processes.

Douglas L. Lehota, Facilities Operations Division. For significant contributions to the safe and reliable operation of the high-voltage electric power system at Lewis.

Regis F. Leonard, chief, Solid State Technology Branch, Space Electronics Division. For significant contributions and outstanding leadership in planning, guiding, and directing the Solid State Technology Program at Lewis.

John J. Nieberding, chief, Advanced Space Analysis Office. For outstanding contributions to many NASA Expendable Launch Vehicle Missions and excellence in advanced mission planning and advocacy.

Edwin R. Procasky, chief, Systems Engineering Office, Lauch Vehicle Project Office. For valuable innovations in system engineering and integration that have enhanced safe, reliable operations of our Nation's intermediate and large expendable launch vehicles.

Richard L. Puthoff, chief, Solar Array Branch, Photovoltaic Power Module Division. For sustained superior performance in the design and development of solar array wings for the Space Station *Freedom* Electric Power System.

George W. Readus, Jr., Test Installations Division. For outstanding technical support, leadership, and personal dedication in achieving key goals of research projects conducted in the Instrument Research Laboratory.

Ronald J. Romanchok, Engineering Support Division. For numerous outstanding contributions to the Engineering Directorate's state-of-the-art design projects supporting advanced aeropropulsion and aerospace research.

Gene E. Schwarze, Power Technology Division. For enabling engineering accomplishments that achieved major technical goals related to space nuclear power systems.

Larry R. Scudder, chief, Operations Division. For outstanding leadership of the government and contractor team that is defining and implementing the operations and facility requirements for the Electrical Power System of Space Station *Freedom*.

Thomas L. Seeholzer, Structural Systems Branch. For creative engineering solutions for the structural systems of the Atlas/Centaur and Titan/Centaur launch vehicles, and for exceptional contributions to pyrotechnic separation systems.

Gary T. Seng, head, Engine Sensor Technology Branch, Instrumentation and Control Technology Division. For outstanding leadership of the High-Temperature Electronics Research Program and the Fiber-Optic- Based Controls Research Program at Lewis.

Dorelia Y. Sharp, Space Station Freedom Directorate. For sustained exceptional performance in support of the management and integration of Space Station *Freedom*.

Frederick F. Simon, deputy chief, Heat Transfer Branch, Internal Fluid Mechanics Division. For many outstanding contributions to both pioneering research and multicultural understanding at Lewis. ◆

Exceptional Engineering Achievement Medal


Ebihara

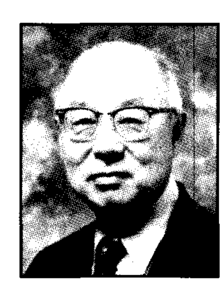
Ben T. Ebihara, Space Electronics Division. For significant innovations in the design of vacuum electronics devices and experimental facilities, particularly those operating at temperature extremes. ◆

Distinguished Public Service Medal


Ostrach

Simon Ostrach, Wilbert J. Austin Distinguished Professor of Engineering at Case Western Reserve University. For significant and far-reaching contributions in guiding and conducting NASA space science research. ◆

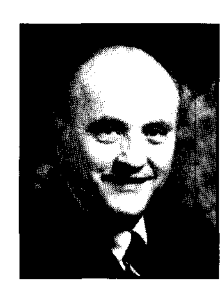
Equal Opportunity Employment Medal


Namkoong

David Namkoong, Power Technology Division. For outstanding efforts and accomplishments in fostering multiculturalism in the Federal workplace and throughout the local community. ◆

Exceptional Scientific Achievement Medal


MacKay


Rice

Rebecca A. MacKay, Materials Division. For exceptional contributions to the understanding of microstructure/property relationships in high-temperature alloys.

Edward J. Rice, Internal Fluid Mechanics Division. For conducting creative and pioneering studies of aeropropulsion system acoustics and developing an internationally used design method to reduce aircraft engine noise. ◆

Center to boost microgravity research

Photo by Tom Jares

Ann Over (left), Microgravity Science Division, and Rick Bowler, Analex, perform a systems check on the Combustion Module-1 (CM-1). The new national center will promote the further development of experiments that explore the combustion process.

(continued from page 1)
made up of CWRU senior scientists and faculty, visiting professors, staff scientists and engineers located at NASA Lewis, CWRU graduate students, and administrative specialists. Simon Ostrach, senior professor of engineering at CWRU, was recently named the center's director.

Center researchers will provide scientific and engineering support to principal investigators conducting microgravity research. They also will contribute on-site scientific support to principal investigators and flight hardware developers during the design, development, and operation of flight experiments and later during analysis and dissemination of their flight research results.

Two drop towers at NASA Lewis will continue to support experiments that require short periods of microgravity. NASA Lewis researchers have been using a retrofitted DC-9 aircraft to conduct research in microgravity for up to 22 seconds. The jet's lease expires in July and NASA Lewis will utilize the KC-135 aircraft based at Johnson Space Center in Houston.

Jack Salzman, NASA Lewis' Microgravity Science program manager, is confident that the new center will enable Lewis to build upon decades of valuable microgravity research.

"The bottom line is that we will look to the center to partner with us to increase the overall return and value of microgravity research wherever, however, and whenever it can be achieved," he said. "The national center will enable us to strengthen and improve our interaction with the science community and in turn heighten the visibility of Lewis' microgravity program." ◆

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Glenn establishes biomedical consortium

Glenn news release

NASA's goal of protecting astronauts' health during long-term space missions has led to the planned infusion of $7.5 million into the Cleveland biomedical community over the next 3 years.

Glenn, the Cleveland Clinic Foundation, University Hospitals of Cleveland, and Case Western Reserve University signed an agreement on June 7 to establish the John Glenn Biomedical Engineering Consortium. The consortium also includes the National Center for Microgravity Research on Fluids and Combustion, a partnership between Case Western Reserve University and the Universities Space Research Association. Using an integrated, interdisciplinary approach, the consortium will combine member

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Consortium will focus on safe human habitation in space

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organizations' unique skills, capabilities, and facilities to achieve common research goals involving human health in space as well as on Earth.

The research will leverage NASA's state-of-the-art knowledge and expertise in the areas of fluid physics and sensor technology together with the other consortium members' world-class capabilities in biomedical research and health care to mitigate risks to astronaut health in long-term space flight.

Conducting research to enable safe and productive human habitation of space is a major goal of NASA's Office of Biological and Physical Research (OBPR), which sponsors this research. Mary Kicza, associate administrator heading OBPR, elaborates, "Long-term space flight exposes human beings to physiological and psychological health risks from radiation, reduced gravity, and isolation and requires the ability to provide crew medical care remotely."

One of the highlights of the signing was Astronaut Dr. Shannon Lucid, now chief scientist for NASA, who spoke to attendees.

Center Director Donald Campbell explained, "The John Glenn Biomedical Engineering Research Consortium reflects not only Glenn's commitment to improving long-term human space flight, but also its impact on the Greater Cleveland community by introducing new technologies applicable to medical products for use by physicians and their patients."

More information on the John Glenn Biomedical Engineering Consortium can be found at *http://microgravity.grc.nasa.gov/grcbio/bec.html.* ◆

Representatives of member institutions signing the consortium agreement are, left to right, Donald Campbell, NASA Glenn; Dr. Huntington Willard, University Hospitals of Cleveland; Dr. Richard Rudick, Cleveland Clinic Foundation; Dr. Patrick Crago, Case Western Reserve University; and Dr. Simon Ostrach, National Center for Microgravity Research.